US-PAT-NO: 5806541

DOCUMENT-IDENTIFIER: US 5806541 A

TITLE: Enhanced draining and drying cycles for an automatic dishwasher

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The preferred embodiment of the present invention relates to an intelligent dishwasher 10 as shown in FIG. 1. FIG. 2 shows a block diagram of the dishwasher 10 using the present invention. FIG. 2 includes a wash process sensor block 12, a microprocessor based controller block 14, and an output block 16. Generally, the controller 14 receives inputs from the wash process sensor block 12, the rinse aid sensor 18, the door sensor 20, the **current** sensor 22, and the control panel switches 24. The controller 14 uses these inputs to control a transistor driver 26 which in turn drives the various components and functions of the dishwasher as shown in the output block 16.

The dishwasher of the preferred embodiment uses a turbidity sensor, conductivity sensor, and wash arm RPM sensor to execute a cycle selection process, which determines whether a load is heavily soiled. If a heavily soiled load is sensed, then a double drain function is incorporated into the drain cycle to remove the extra soil. FIG. 5 is a time line showing the operation of the double drain function. The first drain is a ninety-seven second drain, the exact length of which is variable depending on the motor **current**. When the first drain is complete, there is an

eight second pause
followed by a twenty-five second drain to recreate the siphon effect and remove
the soil and water. The double drain function is used only during the
pre-washes before the main wash.

In a dishwasher, certain substances in the water may cause the water to foam
and not wash the dishes as desired. These substances include for example,
detergents, eggs, powder milks, etc. This reduces the effectiveness of the
dishwasher. Another problem is present when there is a lot of material in the
water which may cause the dishwasher pump to "starve" or not circulate the
water properly. Foaming and starving are detected by monitoring the line
current. If the line **current** drops while the wash arms have slowed, then a
foaming or starved pump condition has occurred. Foaming is detected by a
10%-25% drop in the line **current** combined with a drop in the wash arm speed.
Starving is detectable by a greater than 25% drop in line **current** with a stop
of the wash arm rotation.

The present invention corrects the foaming problem by draining the water and
foam immediately upon detection of the foam. During a normal **fill** of the
dishwasher, the motor is turned off. However, if foaming is detected in the
dishwasher, the motor is turned on during the **fill** subsequent to the indicated
draining to allow as much water as possible to be added to the dishwasher since
circulation of the water will add to the amount of water the dishwasher can
hold. It is desired to add as much water as possible due to the possibility of
the foam causing the **fill** control mechanism to trip prematurely. By recovering
from the foaming in this manner, it is attempted to get rid of as much foam as
possible in the drain cycle portion and add as much water

in the **fill** cycle
portion to create a normal wash action.

Similarly, to correct the starving in the dishwasher, the system water is
drained immediately upon detection of starving. During the drain with
approximately 30 seconds remaining, the water is turned on to attempt to clean
excess food matter out of the pump. The dishwasher is then filled above the
normal level by adding 10 seconds of filling after the motor has been turned
on. This again allows as much water to be added to the dishwasher as possible
since circulation of the water adds to the amount the dishwasher can hold. It
is desired to add as much water as possible to allow the pump to work properly
with the amount of food soil present in the dishwasher. By recovering from
starving in this manner, it is attempted to get rid of as much of the food soil
as possible in the drain portion, and add as much water in the **fill** portion to
create a normal wash action.